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Comparative Study of Analysis of G+6 Building for Different Seismic Zones using STAAD.PRO and ETABS - A Review

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ABSTRACT

STAAD and ETABS are today the market's leading design software. This latest encoded software is used by many design companies. As a result, this project development mainly addresses virtual analysis of the results achieved by designing a multi-story concrete frame design when designed on a separate basis using STAAD and ETAB software. The design consists of load calculations and analysis of the entire structure. STAAD.Pro's and ETABS's design methods are limited state designs in compliance with the Indian Standard Practice Code. The principal aim of the structural engineers is to develop a safe and economical structure using technologies to make it more complicated and large structures for the structural engineer to tackle. STAAD.pro offers state-of-the-art visualisation tools and powerful, dynamic analytical analytical and design engines. STAAD.Pro is the choice of a professional from the generation of the model, analysis and design to the viewing and verification of results. ETABS is currently used by many structural designers as well as a leading design software.

KEYWORDS: *STAAD PRO, E TABS*

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INTRODUCTION

STAAD.PRO and ETABS are two design softwares that can be used to create designs and analyse any type of structure in both static and dynamic modes approach. However, the results of these softwares will vary design and analytical outcomes for the same structural element configurations, as a result of their disparate analytical mechanism and the manner in which they analyse the structure. There is a need to conduct a comparison study between these two software to determine the true benefits and drawbacks of these programmes. When it comes to the analysis and design there is a lot of structure with geometrical irregularities. There is a greater need to compare the design outcomes of various software to create, secure and cost-effective structures.

The design of buildings that prevents damage during a strong but rare earthquake is referred to as earthquake-proof design. Engineers do not attempt to design earthquake-resistant structures that will not be damaged even during a rare but powerful earthquake. Such structures will be both too strong and too expensive. The goal of earthquake resistant design is to create structures that will behave elastically and survive without collapsing during major earthquakes that may occur during the structure's life. To avoid collapse in the event of a major earthquake, structural members must be ductile enough to absorb and dissipate energy via post-elastic deformation.

Many studies have been conducted on this topic, and more are being conducted because the more we learn, the less damage we can cause and the more lives we can save. According to seismology studies, tectonics are responsible for approximately 90% of earthquakes. In civil engineering, an engineer's job is to provide maximum safety in the structures designed while also maintaining the economy.

The necessary information concerning the soil support must be collected by geotechnical investigation prior to analysing and designing all structures. A geotechnical site survey is a process for information collection and assessment of the site's conditions for designing and building the structure's foundation. Structural engineers face problems in ensuring that the final design of the building and the building have to be functional during their design life to the highest efficiency and economic efficiency.

In the earthquake resistant design codes of India[IS 1893 (Part 1), 2002 and 2016], the most recent version of the Indian seismic zoning map provides four areas for seismicity for India. In other words, in contrast to the previous version of India, which comprised five or six size zones, the earthquake-zoning map of India divides India in four seismic zones (zones 2, 3, 4 and 5). Zone 5 is projected to be at the highest seismic level, compared to Zone 2 at the lowest seismic level, according to the present zoning map.

LITERATURE REVIEW:-

1. EznaRafiq et al. (2019) :- The author performed a detailed analysis of the ETABS and STAAD simulation instruments. Pro, used for the analysis and design of the vertical regular and rectangular plane with the Vertical Multi-story Geometrical Irregular Building. The results are obtained and comparable with the results of design using STAAD. Pro and ETABS for rectangular RCC buildings for both regular and irregular plans.The study observed that STAAD.Pro is easier to use, accurate, compatible to analyse design results and much more than ETABS. By comparing the results of two regular and irregular structures, the regular framework elements showed the maximum bending moments of sharp forces and axial forces for various loading conditions in the two software.

2. Akash Panchal et al. (2017):-The author had analyses and develops an existing G+6 RCC framed structure usingSTAAD.Pro V8i. The structure was designed for earthquake forces in several seismic areas according to IS 1893 (Part 1):2002. The main aims of the paper are to compare the change in the percentage of the steel, maximum shear strength, maximum bending moment and maximum bending in various seismic zones. The differences between zone II and zone V are dramatically higher. The percentage of steel, maximum shear strength and maximum moment for bending and deflection from zone II to zone V are increased.

3. ShilpaChouhan et al. (2017):-The author has used Staad.Pro and ETABS to test the models here. The steel truss has been designed with a range of 7m, 10m, 12m, 15m and 18m. Determined steel truss structures with different configurations are analysed for increased structural efficiency. The main work suggested shows that more strength and angle are required if the structure is designed with the same material as Staad.Pro in ETABS, showing less strength. By analysing the diagrams, it was determined from the observations that with the structure span increasing the strength beam and the angle of strength of ETABS compared to Staad.Pro. The study focuses primarily on the analysis of the steel belt configurations for comparison between STAAD. Pro & ETABS, taking the strength parameters into account. In order to obtain optimal and perfect truss design the analytical results are compared.

4. Mohammad Kalim et al. (2018):- In this the author modelled a high elevation G+14 Multi storey structure with identical beam and column cross sections that were analysed and designed for loads using the software. The software STAAD.Pro and ETABs were used to carry out structure analysis of all framework models which include various load conditions on beams, columns and plates. The studied parameters are shear forces, moments bending and deflections.The analytical values for both the software Staad Pro and ETABS are almost similar, but there is little difference and little budgetary design value, so that the analytical values for manual design are adopted in a cost effective way. Analysis was carried out successfully by manually verifying the IS456 using ETABS and STAADPRO software. For the multi-story design of G+14 buildings using ETABS, the amount of steel demand is 9.25 percent less than the STAAD analysis. For the design of the multi-coloured building, STAAD and ETABS analyses are the same amount of cement requirements.

5. Shaik Kamaluddhin et al. (2017):- In this the author analysed the structural components (for example, beams, columns & plates) of the G+12 in order to determine the shear forces, bending times and deflating detail to develop the economic design. Here the author has used ETABS design software to analyse the same structure. The G+12 multifunctional buildings with STAAD.Pro and ETABS were attempted to define the economic section of the building.In reality, the analysis results should correspond to traditional analytical solutions regardless of the type of analysis we use any S/W package. More finely, all the parameters/properties like boundary conditions, material characteristics etc., which can be used by default in the software package to the generated model in the initial phase, are noted in these packages. With the results of the analysis, we can find that the basic reactions to the dead load of the entire structure differ little from all the software. We can also find base reactions that are the same through both software for the living load of the building.Furthermore, for the considered sample column all of the structural software, bending times and shear force are almost identical.

6. Ramanand Shukla et al. (2017):- In this analysis the author analysed a G+10 storey building, both in STAAD Pro and ETABS which had a very simple plan dimension. The study was limited to the fundamental comparison between the results of their analyses under vertical loads. The study then extends the horizontal load and maximises the design position of the lifting wall (shear wall), with a horizontal base shear in the various supporting positions being developed. From different design positions, the model with a central shearing wall has been found to be most effective in handling the base shear.

7. Dunnala Lakshmi Anuja et al. (2019):- In this context, the author thieved to plan, analyse and design a four-story residential building, each with eight apartments each consisting of a master bedroom, a bedroom, a kitchen, a toilet, a dining room and a veranda. In order to analyse and design the framework, STAAD PRO is used to analyse the structural analysis. The designs, columns and beam framing, a staircase and etc are also used in AUTOCAD. The platforms, columns, footing, escalator, sun shadows, lintel, septic tank, high tank "Limit State Method" using the IS: 456-200 code book are included in this project.On comparison with drawing, manual design and the geometrical model using staad.pro the area of AST required for the beam, column, footing and slab are comparatively similar to that of the requirement.

8. Incharaet.al (2016) : The author conducted a study in RC Frame structure regarding seismic design in order to achieve the following aim:

1. To study structural performance in different stainless steel percentages and concrete quantities in various seismic regions of India.
2. Compare the amount of concrete with the percentage of steel reinforcement when drawn up in two different IS codes (i.e. IS 456:2000 for gravity load and IS1893:2002 for earthquake forces). The author makes five models in this study. Four models of the five models are designed and analysed using computer software ETABS in respect of seismic forces and gravity loads for various seismic areas in India. Research has concluded that the supportive reactions are increasing from zone II to zone V, resulting in an increase in steel weight and concrete volume. Also studied in the eastern United States to find a comparison of seismic and wind design. Seismic design

forces are currently sufficient for low-level structures. The lateral forces of Chicago and New York are not very important to design basis shear for either seismic analysis and wind analysis soil classification. Therefore, only wind charge is the only factor that is the major factor when the wind forces are greater when the rocky foundation proportions.

9. IshaBedi et al. (2017): They proposed to use Staad.Pro, ETABS and SAP to conduct a comparative study of RCC Frame Structures. We conclude from the proposed analysis that Staad.Pro is much better. In comparison with ETABS and SAP, force derivative values are low. The maximum derivative value will lead to the max. difference between the Staad.Pro, ETABS and SAP values.

10. Tejashree Kulkarni et al. (2016): The objective of the present study "High rise building analysis and design by Staad Pro 2008," is to define the appropriate technique for the production, cross sections for columns and beam etc. A seismic and wind load combination with staad pro 2008 and comparison is analysed in this research on a 30-story high-rise structure.

CONCLUSION:-

From the above reviews it is clears that both softwaresStaad Pro and Etabs has their own qualities and user-friendly methods which can be adopted for designing and analysing of any structure either for seismic or for any other load conditions. Whether it is a static analysis or dynamic analysis both the softwares has almost the same results. The main difference occurs when it comes to optimization. The quantity of steel in Staad is comparatively more than Etabs which becomes uneconomical for the high rise structures.

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